

*Mr. Newton's Letter to the Publisher of March 26. 1672. containing some more suggestions about his New Telescope, and a Table of Apertures and Charges for the several Lengths of that Instrument.*

S I R,

Since my last Letter I have further compared the two Telescopes, and find that of Metal to represent as well the Moon, as nearer Objects, something distincter than the other. But I must tell you also, that I am not very well assured of the goodness of that other, which I borrowed to make the Comparison; and therefore desire, that the other Experiment should be rather confided in, of reading at the distance of between a 100 and 120 foot, at which I and others could read with it in the *Transactions*, as I found by measure: At which time the aperture was  $1\frac{1}{3}$  of an Inch; which I knew by trying, that an obstacle of that breadth was requisite to intercept all the light, which came from one point of the object.

I should tell you also, that the little plain piece of metall, next the eye-glass, is not truly figured: whereby it happens, that objects are not so distinct at the middle as at the edges. And I hope, that by correcting its figure, (in which I find more difficulty than one would expect,) they will appear all over distinct, and distincter in the middle than at the edges. And I doubt not but that the performances will then be greater.

But yet I find, that there is more light lost by reflection of the metall which I have hitherto used, than by transmission through glasses: for which reason a shallower charge would probably do better for obscure objects; suppose such an one, as would make it magnifie 34 or 32 times. But for bright objects at any distance, it seems capable of magnifying 38 or 40 times with sufficient distinctness. And for all objects, the same Charge, I believe, may with advantage be allowed, if the steely matter, imployed at *London*, be more strongly reflective than this which I have used.

The performances of one of these Instruments of any length being known, it will appear by this following *Table*, what may be

be expected from those of other Lengths by this way, if Art can accomplish what is promised by the Theory. In the *first* Column is expressed the Length of the Telescope in feet ; which doubled gives the semidiameter of the Sphere, on which the concave metall is to be ground. In the *second* column are the proportions of the Apertures for those several Lengths. And in the *third* column are the Proportions of the *Charges*, or diameter of the spheres, on which the convex superficies of the eye-glasses are to be ground.

Lengths.	Apertures.	Charges.
$\frac{1}{2}$	100	100
1	168	119
2	283	141
3	383	157
4	476	168
5	562	178
6	645	186
8	800	200
10	946	211
12	1084	221
16	1345	238
20	1591	254
24	1824	263

The use of this Table will best appear by example : Suppose therefore a half foot Telescope may distinctly magnifie 30 times with an inch Aperture, and it being required to know, what ought to be the analogous constitution and performance of a four foot Telescope : By the second column, as 100 to 476 ; so are the Apertures, as also the number of times which they magnifie. And consequently since the half foot Tube hath an inch aperture and magnifieth 30 times ; a four foot Tube proportionally should have  $4\frac{76}{100}$  inches aperture, and magnifie 143 times. And by the third column, as 100 to 168 ; so are their Charges : And therefore if the diameter of the convexity of the eye-glass for a half foot Telescope be  $\frac{1}{3}$  of an inch, that for a four foot should be  $\frac{168}{500}$ , that is, about  $\frac{1}{3}$  of an inch.

In like manner, if a half foot Telescope may distinctly magnifie 36 times with  $\frac{1}{4}$  of an Inch Aperture; a four foot Telescope should with equal distinctness magnifie 171 times with 6 inches Aperture; and one of six foot should magnifie 232 times with  $8\frac{1}{2}$  inches Aperture; and so of other lengths. But what the event will really be, we must wait to see determined by experience. Only this I thought fit to insinuate, that they which intend to make trials in other lengths, may more readily know how to design their Instruments. Thus for a four foot Tube, since the Aperture should be 5 or 6 inches, there will be required a piece of metal 7 or 8 inches broad at least, because the figure will scarcely be true to the edges. And the thickness of the metal must be proportional to the breadth, least it bend in the grinding. The metalls being polished, there may be tryals made with severall eye-glasses, to find, what Charge may with best advantage be made use of.

*An Extract of another Letter of the same to the Publisher, dated March 30. 1672. by way of Answer to some Objections, made by an Ingenious French Philosopher to the New Reflecting Telescope.*

SIR,

I Doubt not but *M. A.* will allow the advantage of reflexion in the Theory to be very great, when he shall have informed himself of the different *Refrangibility* of the severall rays of light. And for the practise part, it is in some measure manifest by the Instruments already made, to what degree of vivacity and brightness a metaline substance may be polished. Nor is it improbable but that there may be new ways of polishing found out for metal, which will far excell those that are yet in use. And when a metal is once well polished, it will be a long while preserved from tarnishing, if diligence be used to keep it dry and close, shut up from Air: For the principal cause of tarnishing seems to be, the condensing of moisture on its polished surface, which by an Acid spirit, where.